Implementation of Monitoring and Controlling system for Smart Home based on IoT

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Abstract: Internet of Things is making our lives comfortable as new applications are emerging. Smart Home is one such application of IoT which strives for betterment of Human life. This is a project to implement a low-cost Smart Home System that monitors and controls home appliances via a smart phone application over the internet. The system is built using an Arduino Mega microcontroller, ESP8266 ESP-01 Wi-Fi module, some sensors and electrical appliances. All the sensors and appliances connected to the system which are monitored and controlled via Blynk application. Temperature and Humidity are monitored via this application while a notification is sent to the Smartphone for Rain or occupancy. For appliances to be controlled a relay board is used to connect them to the system. The proposed system is low in cost and easy to use and can be accessed from anywhere and anytime via the Blynk mobile application.

Index Terms: Arduino; Blynk; IoT; Smart Home

I. INTRODUCTION

The speed and scope of the Internet has triggered all kinds of ultimate perceptions around the world. A large variety of individuals are getting connected to the Internet via their portable devices every day. Today just about everything is connected and working through the Internet. The role of the Internet is in each invention. Such as machine learning, cloud computing, business intelligence, a web of things, automation and AI tools and services evolution never attainable without the Internet.

Nowadays a Smartphone is able to connect, monitor and control everything possessed by an individual through the Internet. Internet of Things (IoT) is the area of the network which sends and receives the data via the internet without the interference of human, between the things which are connected among themselves for intended activities. Daily the things which we are using are becoming smart with the current technology [1].

21st Century homes will become automated in the future due to the ease and comfort provided by the home automation system by allowing users control of various electrical appliances. Home automation system allows users to control and complete tasks via mobile while the user is busy with other activities automatically from anywhere at any time. With the use of mobiles, a device’s physical location is no longer necessarily be in a range or room connecting and controlling various electrical appliances [2].

According to CISCO, it is analyzed that 50 billion devices would be connected to the Internet by 2020 [4]. From this it can be seen the importance and scale of IoT. Having ease of access to multiple device the IoT makes improvement of numerous applications that utilizes tremendous data to provide new services [2].

The proposed system has a microcontroller as the central part with wi-fi module to connect to the internet. The system allows the user to access the system from various smartphones.

II. KEY COMPONENTS OF THE SYSTEM

Arduino Mega 2560: The project uses Arduino Mega as the central part of the system due to its low cost and ease of programming as it is open source and cross platform hardware and software. The sensors are connected to the microcontroller which act as input and the appliances connected.[5]

Fig.2 Arduino Mega

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ESP8266 ESP01 Wi-Fi Module: The ESP8266 is a low-cost Wi-Fi microchip. This Wi-Fi module has 8 pins which are used to connect with Arduino Mega and the compatible logic level of this module is 3.3V only. In this project this Wi-Fi module is specifically chosen because of its low cost and more features which makes the module highly efficient for IoT applications.

Fig. 3 ESP8266 ESP-01 Wi-Fi Module

Relay board: A relay is an electrically operated switch which regulates and control the power. Relay boards main function is to control appliances which are taken as an example for real appliances. It takes the input signal from the Arduino Mega and based on the signals it controls the devices.

Fig. 4 Relay Board

Blynk: Blynk is a platform for IoT. It works with most of the board available for example Arduino, Raspberry Pi and other development kits. Blynk has three major components namely Blynk App, Blynk Server and Blynk server [6].

- The Blynk App allows to create the interfaces for the project.
- The Blynk Server is what makes communication between the hardware and the smartphone by providing a private local server or Blynk cloud provided by Blynk.
- Blynk Libraries are used for communication with hardware with the commands.

Fig. 5 Blynk Architecture. Source: [6]

Sensors and Electrical Appliances: A DHT11 sensor, Rain Drop Sensor and IR sensor are used for monitoring the Temperature, Humidity, Rain and occupancy. A bulb and a Fan are illustrated a for real appliances which are connected to the relay board.

III. SYSTEM ARCHITECTURE AND IMPLEMENTATION

The Home Automation System is implemented using an Arduino Mega 2560 microcontroller, ESP8266 ESP-01 Wi-Fi module, Relay Board, sensors and a few electrical appliances. The Arduino Mega is connected to the Blynk Server over the Internet via ESP8266 Wi-Fi module. The sensors are connected to the microcontroller which act as input signals. The output signals from the Arduino are sent to the relay board to control the appliances. Some sensor data like Temperature, Humidity are constantly sent to the sever to display on Smartphone and notifications are sent by the server to the Smartphone for occupancy or Rain. The Architecture of the implemented system is as shown in Fig. 6. The implemented system prototype is shown in Fig. 7.
After the system is implemented, open the Blynk Application in the mobile and create a new project and set the board as Arduino Mega and a token is generated and sent to the mail. The token is used in the code for the Smart Home system. The code is uploaded into the controller and the Home Automation System is ready to connect to the Smart phone. Display and buttons are added as shown in Fig.8

IV. RESULTS AND DISCUSSION

The code for the Smart Home system is uploaded into the Arduino Mega and it starts trying to connect to the project and the application is started in the mobile and selecting the project that was implemented and running it after the application notifies that the establishment of connection.

The Application UI is as shown in Fig.8. Temperature and Humidity are display on the screen, whereas Rain and occupancy are notified as show in Fig. 9 and Fig. 10

Fig. 8 Blynk UI for the Smart Home

There are two buttons used for controlling the bulb and fan, even more appliances can be controlled if appliances are connected to the relay and some more buttons are added for control. The notification here pops-up whenever rain or someone entered, an email can also be used for notification instead of a pop-up.

Fig. 9 Notification of Rain Fall

Fig.10 Notification when someone entered
V. CONCLUSION AND FUTURE SCOPE

This project proposed a low-cost Smart Home system and a prototype is implemented using Arduino Mega and Blynk Smartphone Application. The system has three sensors to monitor the conditions at home and a relay board is used to control appliances, here only bulb and fan are used, more appliances can be connected. The Blynk application is free and easy to use due to its simple UI.

More sensors can be interfaced to the system and can be implemented for real appliances. For security purposes private local servers can also be set. The project that is created can also be made into an app to publish for other users.

REFERENCES

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